LIBRARY
FISH & WILDLIFE SERVICE
PACIFIC OCEANIC FISHERY
INVESTIGATIONS

BRITISH MUSEUM (NATURAL HISTORY)

THE
JOHN MURRAY EXPEDITION
1933–34

SCIENTIFIC REPORTS

VOLUME V. No. 1

PHYLLIRHOIDÆ

BY

H. G. STUBBINGS, B.A.(CANTAB.), B.SC.(LOND.)

(Late Scholar of St. Catharine's College, Cambridge)

WITH FIVE TEXT-FIGURES

LONDON:
PRINTED BY ORDER OF THE TRUSTEES OF THE BRITISH MUSEUM

SOLD BY

B. QUARITCH, LTD., 11 GRAFTON STREET, NEW BOND STREET, LONDON, W.1; DULAU & CO., LTD., 29 DOVER STREET, LONDON, W.1; OXFORD UNIVERSITY PRESS, WARWICK SQUARE, LONDON, E.C.4; H.M. STATIONERY OFFICE, LONDON, S.W.1

AND AT

THE BRITISH MUSEUM (NATURAL HISTORY), CROMWELL ROAD, LONDON, S.W.7

1937

[All rights reserved]

Price Two Shillings

[Issued 27th November, 1937]

DESIGNED AND
PRINTED
BY

AT
BARTHOLOMEW PRESS
DORKING

Made and printed in Great Britain

LIBRARY
FISH & WILDLIFE SERVICE
PACIFIC OCEANIC FISHERY
INVESTIGATIONS

PHYLLIRHOIDÆ

BY

H. G. STUBBINGS, B.A.(Cantab.), B.Sc.(Lond.)

(*Late Scholar of St. Catharine's College, Cambridge*)

WITH FIVE TEXT-FIGURES.

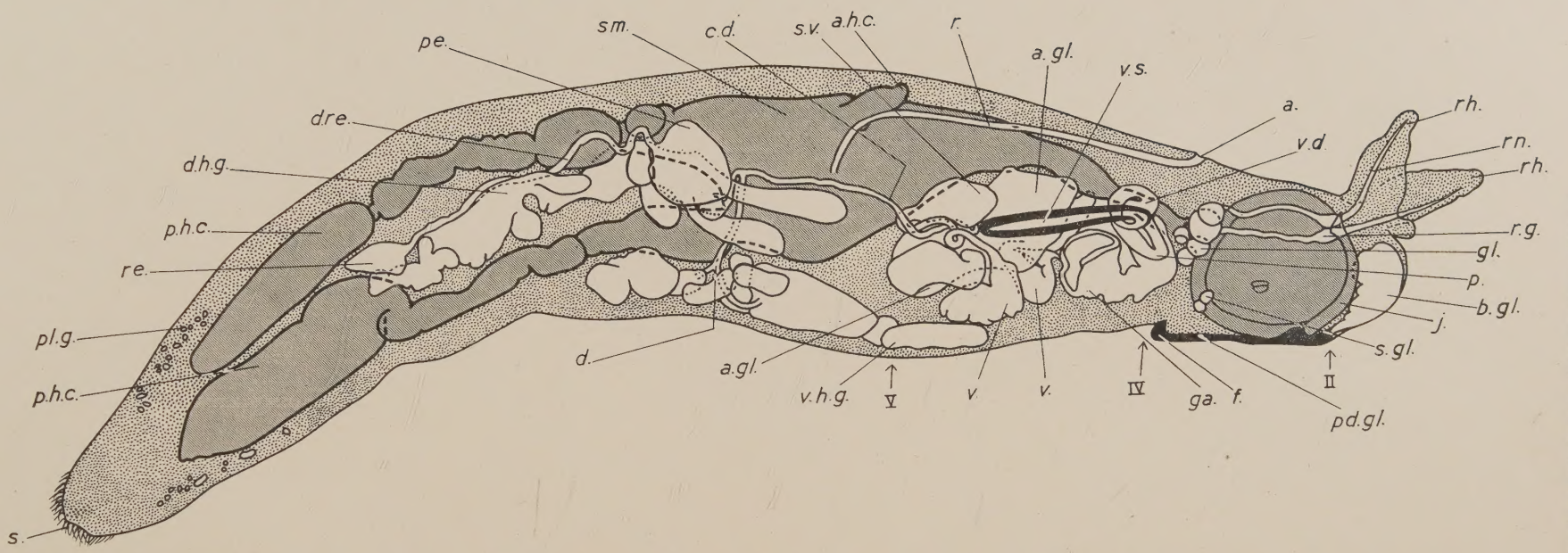
The Phyllirhoidæ of the " John Murray " Expedition are few in number and represent a new species of the genus *Cephalopyge*. As this species incorporates characters hitherto regarded as diagnostic of one or the other of the two subgenera of *Cephalopyge* recognized by Thiele (1931, p. 446), the systematic grouping of the several species is here discussed and revised. This is particularly necessary, as many previous workers in this field appear to have overlooked considerable portions of the literature. For this reason, also, I have given a full synonymy and references for each species, and as full a bibliography as possible of those works dealing more or less directly with the genus *Cephalopyge* as at present defined.

Cephalopyge arabica sp. nov.

Occurrence.—(i) Sta. 96, Central part of Arabian Sea, 10 metres, 4 specimens.
(ii) Sta. 131 D, Southern Area of Arabian Sea, 500–0 metres, 1 specimen.

Description.—The animal is elongated and laterally compressed. The tail is long and rounded posteriorly and bears a terminal fringe of short curved setæ. The dimensions of one of the largest specimens are as follows: length 5·6 mm., greatest depth 1·2 mm., width 0·4 mm., length of rhinophores 0·6 mm. These dimensions are somewhat smaller than those of the majority of examples of species of *Cephalopyge* described by previous authors. Pierantoni (1923, p. 84) gives 15–17 mm. as the length of *Boopsis mediterranea*, considerably more than that given by Chun for *Cephalopyge trematoides* (Chun)—7–10 mm. —which I regard as the same species. André on the other hand records a specimen of *Ctilopsis picteti* only 3 mm. long, presumably a young animal. Some of the present specimens may likewise be immature individuals. The appearance of the whole animal is shown in Text-fig. 1.

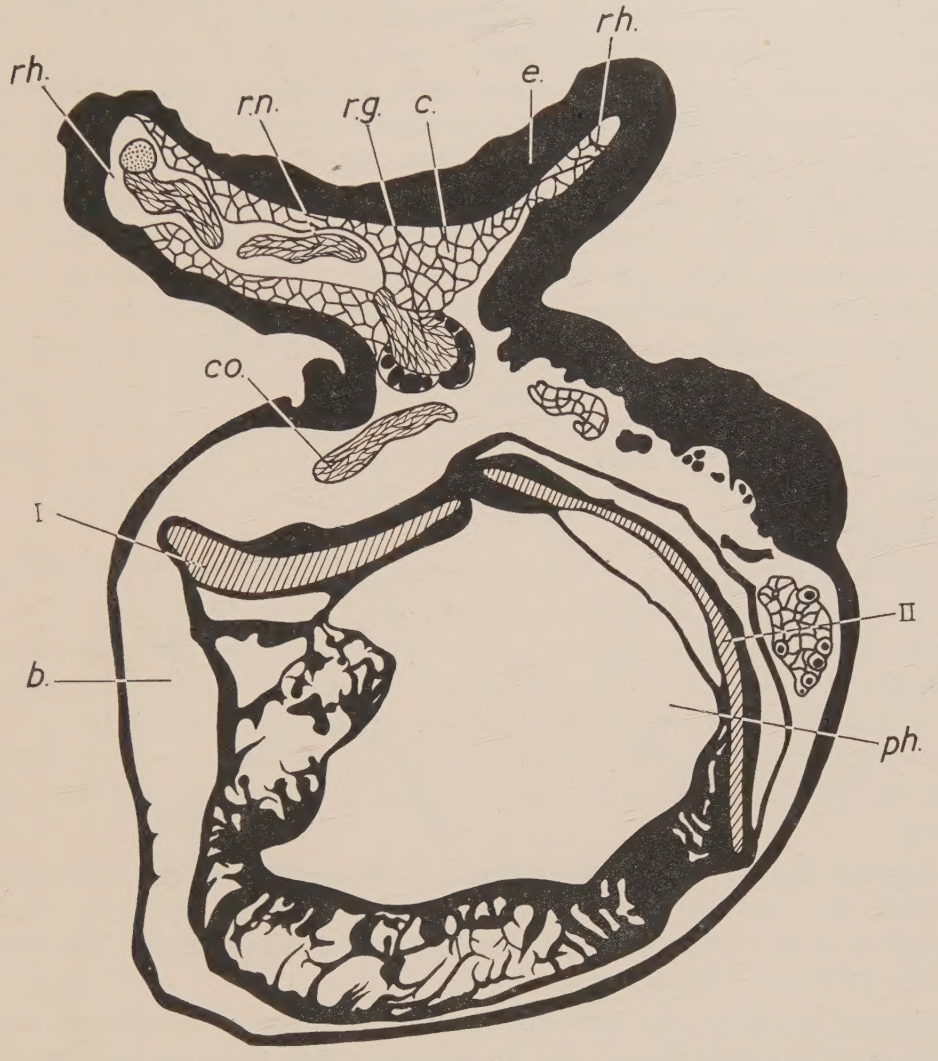
The foot is poorly developed, and projects only slightly beyond the ventral surface of the animal. The pedal gland runs back from the mouth as a narrow deeply-stained track



TEXT-FIG. 1.—*Cephalopyge arabica* sp. nov. Complete animal as drawn from a whole stained preparation with additional details added from sections. *a.*, anus. *a.gl.*, accessory gland. *a.h.c.*, anterior hepatic cæcum. *b.gl.*, buccal glands. *c.d.*, common hermaphrodite duct. *d.*, hermaphrodite duct. *d.h.g.*, dorsal hermaphrodite gland. *d.re.*, duct of renal organ. *f.*, posterior part of foot. *g.a.*, genital atrium. *gl.*, nerve ring. *j.*, jaws. *p.*, penis. *pd.gl.*, pedal gland. *pe.*, pericardium. *p.h.c.*, posterior hepatic cæcum. *pl.g.*, glands in body-wall. *r.*, rectum. *re.*, renal organ. *r.g.*, rhinophore ganglion. *rh.*, rhinophores. *r.n.*, rhinophore nerve. *s.*, setæ. *s.gl.*, salivary glands. *sm.*, stomach. *s.v.*, seminal vesicle. *v.*, vagina. *v.d.*, vas deferens. *v.h.g.*, ventral hermaphrodite gland. *v.s.*, thick-walled part of vas deferens (? sperm-sac). II, IV, V, mark the position of the sections shown in Text-figs. 2, 4, and 5.

as far as the posterior border of the foot, which is indicated by a notch in the outline of the animal.

The rhinophores are stout, laterally-directed, conical projections arising a little behind the extreme anterior end of the animal. They are solid structures with a thick



TEXT-FIG. 2.—*Cephalopyge arabica*. T.S. through the origin of the rhinophores. *b.*, cœlom. *c.*, connective tissue. *co.*, connective between left cerebro-pleural and rhinophore ganglia. *e.*, thick columnar epithelium and musculature of rhinophores and adjacent part of body-wall. *ph.*, pharynx. *r.g.*, rhinophore ganglion. *rh.*, rhinophores. *r.n.*, rhinophore nerve. I, II, left and right jaws.

epidermis overlying a layer of compact, apparently muscular tissue. Within this is a mass of connective tissue, compact peripherally, but somewhat lacunar in the centre. In the compact tissue are numerous deeply-staining round or oval cells apparently similar to the gland-cells described by Pierantoni (1923, p. 86). Up the centre of each rhinophore runs a nerve arising from a ganglion at the base of the rhinophore (Text-fig. 2, *r.n.*).

The structure of the body-wall and connective tissue has been described by Hanel (1905, p. 454) for *C. trematoides* (Chun), André (1906, p. 75) for *Ctilopsis picteti*, and Dakin

and Colefax (1936, p. 458) for a species then thought to be probably identical with *Ct. picteti* André (but see Dakin and Colefax, 1937, p. 271). The glands in the body-wall (Text-fig. 1, *pl.g.*) have been exhaustively described by Pierantoni (1923, p. 86) for a species called by him *Boopsis mediterranea*. Similar glands are present in the present species ; they are especially abundant in the posterior third of the body. The epithelium is flattened except on the rhinophores, extreme anterior and posterior ends of the body and the foot, in which regions it is columnar.

The longitudinal muscle-strands agree with the descriptions given by previous authors. The connective tissue is mainly confined to a thin layer in the body-wall, thicker dorsally and ventrally. As Hanel (1905, p. 455) has observed, this tissue forms a thin layer over the digestive and reproductive organs, which it binds together. As mentioned above, it fills the rhinophores. The perivisceral cavity is traversed by a few strands of connective tissue. Behind the accessory reproductive organs (*i. e.* in the posterior two-thirds of the body) there are only two strands of connective tissue traversing the body-cavity horizontally, and so dividing it into three compartments lying in a vertical series. These " partitions " do not seem to have been recorded by previous investigators. The posterior hepatic cæca lie in the upper and lower compartments, and the dorsal hermaphrodite gland and the renal organ in the centre one. I have not observed the " myoblastes " described by André in *Ct. picteti*. Dakin and Colefax (1936, p. 458) also failed to identify these structures.

The mouth is anterior or very slightly deflected downwards (*cf. Phyllirhoë* spp., in which the mouth is characteristically antero-ventral). It is surrounded by a glandular area or (in a second specimen) by two lateral, swollen glandular lips. Similar glandular lips in *Boopsis mediterranea* are figured without description by Bertolini (1935, p. 68, fig. 4), and Vessichelli (1906, p. 125, pl. v, figs. 11–13) describes and figures the " glandole boccali " of *Phyllirhoë bucephala*. There does not appear to be a longitudinal ciliated groove on the foot, leading to the mouth, such as Pierantoni describes in *Boopsis mediterranea*.

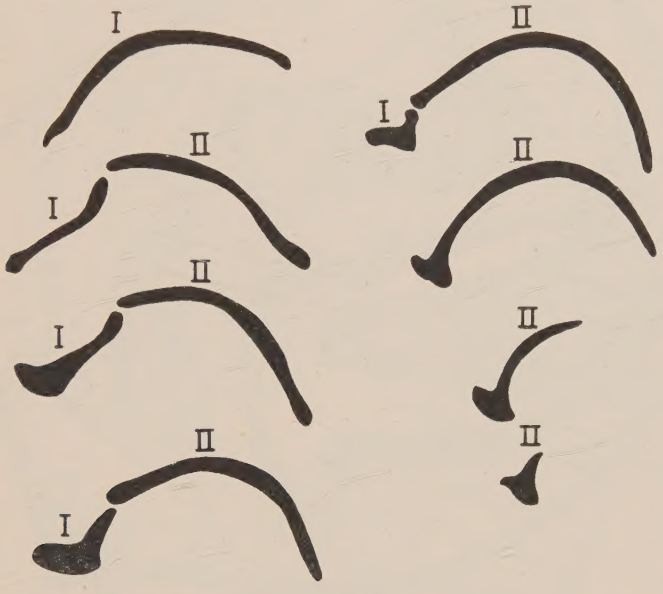
The salivary glands are extremely small, being represented by two small deeply-staining bodies seen through the pharynx in the whole animal. They were not identified in transverse sections of the animal. André (1906, p. 76) remarks that the salivary glands in *Ct. picteti* are " fortement réduites ".

The pharynx is a large, spherical, thick-walled structure. Its walls are composed of transversely-running muscle-fibres. In the specimen sectioned the pharynx is concave on the left side, with the ganglia of this side lying in the depression. This is most probably an artifact due to contraction during preservation. A curved bar-like structure can be observed, in the whole animal, lying on the anterior periphery of the pharynx. In section this resolves itself into two bars—the jaws—lying side by side. Their appearance in successive transverse sections is shown in Text-fig. 3, I representing the left jaw, II the right. Owing to distortion of the pharynx they have been sectioned somewhat obliquely, which accounts for only one jaw showing in the first and last few sections. The complete jaws probably have a shape similar to that given by Pruvot (1929, p. 468, fig. 2) for *Boopsis mediterranea*. They are devoid of interlocking teeth as in that species.

No trace of a radula can be found in the specimen sectioned, nor is such an organ visible in the stained and mounted specimen. Baba (1933, p. 158) likewise was unable to detect the radula in *Cephalopyge* (*Cephalopyge*) *orientalis*, described and named by

him, though he considers that it may have been overlooked, as all the other species then known possessed a radula. Dakin and Colefax (1936, p. 457) were unable to find a radula in their specimens either by dissection or sectioning, though these closely resemble *Ct. picteti* André, for which this author describes and figures a median and a lateral tooth. In a further paper (1937) on the same specimens the absence of the radula is confirmed by Dakin and Colefax, who now regard their specimens as probably identical with *C. orientalis* Baba. Pierantoni (1923, p. 89) described a **T**-shaped structure in the mouth of *Boopsis mediterranea* devoid of teeth. Pruvot (1929, p. 471), however, has shown that this bears a few very small teeth, but adds that there is no trace of a sheath (" gaine ").

There are three hepatic cæca, the anterior being very small and little more than a small pouch on the stomach-wall. The rectum is an exceedingly narrow tube opening

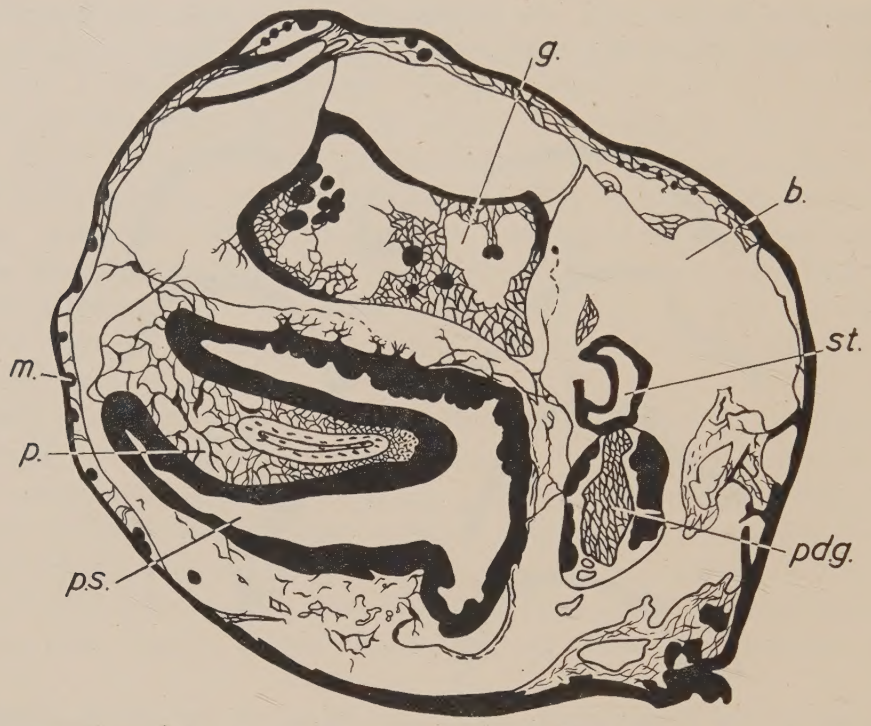


TEXT-FIG. 3.—T.S. through the jaws at successive levels. I, II, left and right jaws.

medianly at the back of the head just behind the nerve-ring. The anus may be raised on a slight projection.

The nervous system (Text-figs. 2, 4) is very similar to that described by André (1906, p. 77), Pierantoni (1923, p. 87) and Dakin and Colefax (1936, p. 458). There is a circum-œsophageal ring of four ganglia ; two dorsal cerebro-pleural ganglia lying in contact, and attached to each a lateral pedal ganglion. The pedal ganglia are connected together by a long commissure. From each cerebro-pleural ganglion a nerve runs forwards to a rhinophore ganglion. These ganglia lie close together, and from each a single nerve runs up each rhinophore (Text-figs. 1, 2, *r.n.*). The simple black pigment-spots or " eyes " lie ventrally on the cerebro-pleural ganglia as described and figured by Dakin and Colefax (1936, p. 458, pl. iv, fig. 9). Paired statocysts (Text-fig. 4, *st.*) lie on the nerve-ring at the junction of the pedal and cerebro-pleural ganglia. The stomatogastric ganglia are presumably united by a short commissure as they lie a little apart and not in apposition as described by Dakin and Colefax. Owing to distortion these two ganglia are not both included in any one of the series of sections, and I have been unable to trace this commissure.

The renal organ can be seen in sections as a thin-walled sac arising at the hinder end of the upper hermaphrodite gland and continuing forwards as a narrow duct. In the intact animal it is just possible to make out the duct following a somewhat sinuous course forwards towards the pericardium. It follows the course previously described by authors for other species, running forwards and to the right side and turning upwards at about one-third of the distance from the posterior end of the animal. Here it opens to the exterior by a small pore a little to the right of the mid-dorsal line. The duct then continues forwards between the body-wall and the dorsal posterior hepatic cæcum and enters the pericardium.

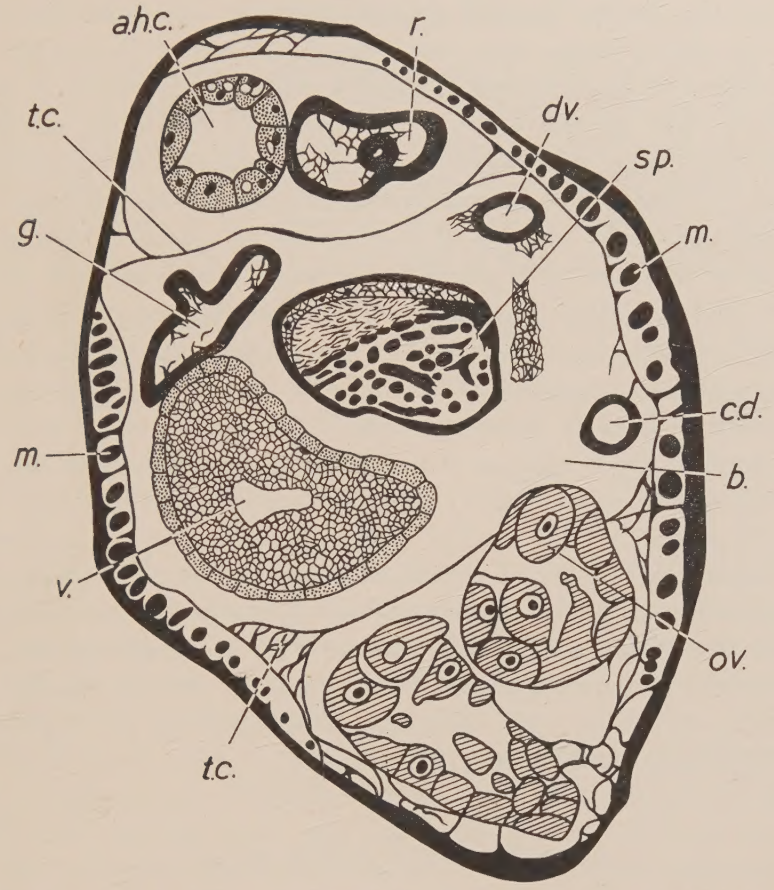


Text-fig. 4.—T.S. through penis, statocyst and right pedal ganglion. *b.*, cœlom. *g.*, gut. *m.*, longitudinal muscles of body-wall. *p.*, penis. *pd.g.*, right pedal ganglion. *p.s.*, penis-sheath. *st.*, statocyst.

The hermaphrodite glands consist of two (or possibly three) horizontal, irregularly-lobed bodies lying in the usual position (Text-figs. 1, *d.h.g.*, *v.h.g.*; 5, *ov.*, *sp.*). The ventral gland is slightly anterior to the other, as in previously-described species. From the ventral hermaphrodite gland two very short ducts arise, one from the anterior portion and the other from the larger posterior portion. They join, and the single duct (Text-figs. 1, *d.*; 5, *c.d.*) runs upwards to meet the duct from the other gland which lies between the hepatic cæca. This duct runs beside the pericardium. The common duct then runs forwards until just anterior to the stomach, where it forks into two. One branch, the vas deferens, continues forwards as a narrow tube which widens almost at once into a thick-walled tube (Text-fig. 1, *v.s.*), possibly the sperm-sac, distinctly visible in the whole animal, and then is joined to the muscular unarmed penis (Text-figs. 1, 4, *p.*) by a short, narrow, coiled duct.

The other branch widens into a small sac, the vesicula seminalis, from which a narrow duct arises, widening out into the large coiled vagina.

Bound up with the vagina are the accessory glands. These appear to be two in number, and are presumably attached to the inner end of the vagina as figured by Pierantoni (1923, pl. iii, fig. 7) for *Boopsis mediterranea* and by Dakin and Colefax (1936, pl. iv, fig. 7) for ? *Ctilopsis picteti*, though it is exceedingly difficult to make out all the parts seen in a cross-section, especially as this part of the animal seems to have been very strongly contracted in the specimen sectioned. Vagina and penis open into the genital



Text-fig. 5.—T.S. through rectum, anterior hepatic cæcum and hermaphrodite glands. *a.h.c.*, anterior hepatic cæcum. *b.*, cœlom. *c.d.*, common hermaphrodite duct. *d.v.*, duct from seminal vesicle to vagina. *g.*, gut. *m.*, longitudinal muscles of body-wall. *ov.*, ova in diverticula of ventral hermaphrodite gland. *r.*, rectum. *sp.*, spermatozoa and undifferentiated gonadic cells in dorsal hermaphrodite gland. *t.c.*, transverse strands of connective tissue. *v.*, vagina.

atrium a short distance behind the pharynx on the right side. The genital pore lies here a little below the middle line at the level of the œsophagus. No minute papillæ are present on the penis. This is in accordance with the results of other authors, and appears to be a characteristic of *Cephalopyge* as distinct from *Phyllirhoë*, in which the penis is said to be " armed ".

The form of the gonads differs somewhat from previous descriptions. Hanel (1905, p. 458) describes the hermaphrodite glands in *Cephalopyge trematoides* (Chun) as " . . . gelappt oder mit ziemlich grossen zottenformigen Ausstülpungen bedeckt. In diesen werden peripher die Eier, central Spermatozoen gebildet . . . " Five such glands

are reported for this species, three lying between the hepatic cæca and two ventrally. André (1906, p. 78) describes three gonads in *Ct. picteti* " . . . formé par les digitations, . . . attachés à un axe ou canal médian ". Dakin and Colefax (1936, p. 459) give a very similar description for their specimens. Baba (1933, p. 158) describes a new species, *Cephalopyge* (*Cephalopyge*) *orientalis* with four gonads " formed of a large testis accompanied by a large number of finger-like ovaries ". Thus the gonads in these three species do not differ to any great extent. Especially is this evident when the different figures are compared. In the present species, however, the hermaphrodite glands are rather irregular, elongated bodies with only a small number of diverticula varying in size according to the degree of development of the ova, which occur mainly in these diverticula (*cf.* Hanel, 1905, p. 458, quoted above). The body of the organ contains developing spermatozoa and small round-cells, either undeveloped gametes or yolk-cells. The gonads thus definitely do not consist of a central axis with numerous lateral finger-like branches.

As mentioned above, the number of hermaphrodite glands is two or three. In no specimen could more than one such gland be definitely traced between the hepatic cæca. In one specimen examined the number of ventral glands appeared to be two, and this interpretation is supported by the terminally forked hermaphrodite duct leading from this organ. The specimen appeared to be young as only a few large eggs were present. In another specimen with more developed eggs in the diverticula it was not possible to distinguish two ventral glands even in the serial sections. It is possible, therefore, that the ventral hermaphrodite gland develops from two centres, and that they grow together, forming a single mass in the adult or ripe animal. In this way it is possible to explain the great variation in the number of gonads recorded in different species, assuming that those with few gonads (two or three) are adult specimens or those carrying ripe eggs and spermatozoa, and that those with many (four or five) are either juvenile specimens or those which have shed the genital products, and in which the gonads have shrunk back to the non-breeding condition. The difficulty of determining the number of glands is also pointed out by Dakin and Colefax (1937, p. 270).

Affinities of *C. arabica* sp. nov.

In the following paragraphs I have kept to the nomenclature used by Thiele (1931, p. 446).

C. arabica agrees with the subgenus *Ctilopsis* as defined by Thiele in having a rudimentary foot, though this is more distinct than that of *Cephalopyge* (*Ctilopsis*) *picteti* (André), ? *Ctilopsis picteti* Dakin and Colefax (1936, p. 456), in which the foot is represented by the pedal gland only, or *Cephalopyge orientalis* Baba. On the other hand, the tapered and rounded tail is far more like that of a typical *Cephalopyge*.

The species differs from *C. trematoides* (Chun) and *C. mediterranea* (Pierantoni) in having a reduced foot. In this it agrees with *C.* (*Ct.*) *picteti* and *C.* (*C.*) *orientalis* Baba. It is sharply distinguished by its elongated rounded tail from *C.* (*Ct.*) *picteti*, in which the tail is short and sharply truncated.

C. arabica agrees most nearly with *C. orientalis* Baba in the absence of a radula, and the presence of a very small foot and long tail, though in this latter species the tail is more abruptly terminated than in the new species. It differs from *C. orientalis* in having only three hermaphrodite glands in the young individual and in the form of the intestine. In

C. orientalis the intestine is a rather broad tube narrowing towards the anus, but in the new species it is an exceedingly narrow tube right from its origin. The tail is more rounded than in *C. orientalis* and has a terminal tuft of setæ not hitherto recorded for any species.

Accordingly I propose to regard it as a new species under the name *Cephalopyge arabica* sp. nov.

Systematic Revision of the Genus *Cephalopyge*.

The family Phyllirhoidæ has been divided into several genera, only one of which, *Phyllirrhoe* Peron et Lesueur, is known from a number of well-defined species. Thiele (1931, p. 446) defines *Phyllirrhoë* as follows : " Körper ziemlich breit, hinten verschmälert, mit vortretender Schnauze und nach vorn gerichteten Rhinophoren ; After an der rechten Seite. " Those species not agreeing with this diagnosis have been given various generic and specific names. The following is a list of these in chronological order :

Phyllirhoë trematoides Chun, 1889	.	*Boopsis mediterranea* } Pierantoni, 1923.
Cephalopyge trematoides Hanel, 1905	.	*Boopsis trematoides* }
Ctilopsis picteti André, 1906	.	*Cephalopyge* (*Cephalopyge*) *orientalis* Baba, 1933.
Ctilopsis trematoides Vessichelli, 1906	.	? *Ctilopsis picteti* Dakin and Colefax, 1936.

The position of some of the various names put forward by authors for *Cephalopyge* species has been briefly summarized by Dakin and Colefax (1937, p. 267), who also give a summary of the species, based on Thiele's classification, admitting four species with the possibility of a fifth to include their Australian specimens. These, however, were later considered to belong to an existing species.

The following discussion is a more detailed review of the nomenclature.

Of the above eight names, *Phyllirhoë trematoides* Chun was shown by Hanel (1905) not to be a *Phyllirhoë*, and was more fully described by that author as the type of a new genus of Phyllirhoid—*Cephalopyge*—under the name *Cephalopyge trematoides* (Chun).

André (1906), unaware of Hanel's work, described specimens from Amboina under the name *Ctilopsis picteti*. This species is distinct from *C. trematoides*, and to it Dakin and Colefax (1936) originally considered their south-east Australian specimens probably belonged, despite certain differences in structure mentioned by these authors. They now (1937) prefer to regard them as a form of *C. orientalis* Baba.

Vessichelli (1906, p. 131) recognized that Chun's species was not a *Phyllirhoë* and placed it in André's genus *Ctilopsis*, apparently unaware of Hanel's erection of the genus *Cephalopyge*. Hence *Ctilopsis trematoides* is a synonym of *Cephalopyge trematoides* (Chun).

Pierantoni (1923, p. 93), overlooking previous work, erected a third genus, *Boopsis*, to receive a specimen described by him under the name *B. mediterranea* from Naples. In considering the imperfectly described *Phyllirhoë trematoides* he remarked that " . . . la specie delle Canarie descritta (assai incompletamente in vero) dal Chun nel 1889 viene compresa nel nuovo genere constituito dalla forma da me rinvenuta ed in anzicchè *Phyllirhoë trematoides* dovrà chiamarsi *Boopsis trematoides* ". Bertolini (1935, p. 68) adhered to this view, following Pierantoni, and likewise having overlooked Hanel's

paper. Hence as pointed out by Pruvot (1929, p. 475), " c'est *Boopsis* qui doit tomber, et *Cephalopyge* qui, ayant la priorité, persistera ".

According to Dakin and Colefax (1936, pp. 459–60) the anatomy of ? *Ctilopsis picteti* " strengthens the relationship between the genus *Ctilopsis* and that of *Boopsis* described by Pierantoni . . . ".

Hence on the views of the above authors *Cephalopyge trematoides* (Chun), *Ctilopsis picteti* André and *Boopsis mediterranea* Pierantoni ought to be grouped together in a single genus, in which *Cephalopyge* would have priority. Hence the valid species would be—

Cephalopyge trematoides (Chun),
C. picteti (André),
C. mediterranea (Pierantoni).

When *C. trematoides* is compared with *C. mediterranea* the resemblance is seen to be very great, and Pruvot (1929, p. 475) says: " N'était cette incertitude où nous sommes au sujet de sa radula (Hanel did not examine it closely), je serais de son avis (*i. e.* Pierantoni's view) sur l'identité générique des deux espèces ; et qui plus est, *leur valeur spécifique même me paraîtrait incertaine* " (italics are mine). She adds that the only difference—five gonads instead of two—is much less evident in the figures than in the text. The presence or absence of a radula is important in classifying Nudibranchs, but in no species of *Cephalopyge* is it very highly developed. That shown by Pruvot (1929, p. 468, figs. 3, 4), indeed, appears extremely rudimentary. Hence it is probable that the radula may be more developed in some specimens than in others. Pruvot suggests that once the animal is adult tooth-production may stop and that the radula is degenerate. Thus the radula may even be absent in some adult animals. The question of a radula in *C. trematoides* need not, then, militate against grouping the two species together, and there is reasonable justification for regarding *Boopsis mediterranea* as a synonym of *Cephalopyge trematoides* (Chun). Dakin and Colefax, in their latest paper (1937, p. 267), consider these species as distinct.

The remaining species, *C.* (*C.*) *orientalis* Baba, is quite distinct. To this species, as mentioned above (p. 5), Dakin and Colefax consider their specimens to belong, preferring to regard them as a southern Pacific form of *C. orientalis* Baba from the North Pacific, rather than as a separate species.

Thiele (1931, p. 446) was of the opinion that the species all belonged to one genus, *Cephalopyge*, which he proceeded to divide into two subgenera thus :

(i) *Cephalopyge* s.str., " Fuss deutlich ausgebildet, Schwanz ziemlich lang ". Including *C. trematoides* and *C. mediterranea.*

(ii) *Ctilopsis* André, " Fuss rudimentar, Schwanz kurz und breit, gerade abgestutzt ". Including *C. picteti* only.

This division of the genus was adopted by Baba (1933) in describing *Cephalopyge* (*Cephalopyge*) *orientalis.* Baba gives a list of five characters in which this species " agrees with the genus *Cephalopyge* . . . " (p. 159). The last of these is " (5) in the presence of 3 hepatic sacs, of which *the anterior one is short* " (italics mine). The importance of this last phrase is obvious as describing a character in which it agrees with the subgenus *Ctilopsis.* He excludes it, however, from *Ctilopsis* on the grounds of having an extended tail, a character appertaining to *Cephalopyge* s.str. according to Thiele. On the other hand the foot is rudimentary (" not well-developed "), in which it agrees with *Ctilopsis.*

It is obvious then that this species is intermediate between the two subgenera, and so the division into subgenera breaks down. The present new species, *Cephalopyge arabica*, is likewise intermediate. Dakin and Colefax (1937, p. 268) also consider that the grouping of the species into subgenera is unnecessary.

The following is a more complete diagnosis of the two genera of Phyllirhoidæ, *Phyllirhoë* and *Cephalopyge*.

Family Phyllirhoidæ.

Genus 1 : *Phyllirhoë*.

Phyllirhoidæ with a distinct proboscis and forwardly directed rhinophores ; hepatic cæca four ; rectum directed backwards ; anus opening on right side near renal pore ; foot absent ; penis armed with papillæ ; accessory genital glands absent.

Genus 2 : *Cephalopyge*.

Phyllirhoidæ with no distinct proboscis and rhinophores laterally directed ; hepatic cæca three, the antero-ventral lost and the antero-dorsal often greatly reduced ; rectum directed forwards ; anus opening in or about the middorsal line immediately behind the head ; foot present, rudimentary or only indicated by the pedal gland ; penis unarmed ; accessory genital glands present.

The four species of *Cephalopyge* can be separated on the basis of the following key.

Genus *Cephalopyge*

- Radula present
  - Anterior hepatic cæcum short ; tail very short, sharply truncated . . . . . *Cephalopyge picteti* (André).
  - Anterior hepatic cæcum long ; tail long, tapering and truncated *C. trematoides* (Chun).
- Radula absent
  - Intestine broad at least at proximal end ; tail long, sharply truncated . . . . . *C. orientalis* Baba.
  - Intestine a very narrow tube throughout ; tail tapering, rounded posteriorly, with terminal setæ . . . . *C. arabica* sp. nov.

In the above key I have omitted any reference to the hermaphrodite glands for, as stated above (p. 8), I believe the actual number is apparent in the young animals only, being obscured in the adults by the growth of the organs themselves so that only two or at most three are visible. Dakin and Colefax (1937, p. 270) also consider the number of hermaphrodite glands a doubtful character for determining the species.

Genus *Cephalopyge* Hanel.

Cephalopyge picteti (André).

Ctilopsis picteti, André, 1906, p. 72, pl. i.
Ctilopsis picteti, Pierantoni, 1923, p. 93.
Cephalopyge (*Ctilopsis*) *picteti*, Thiele, 1931, p. 446.

Recorded Distribution.—Amboina (André).

Description.—For a description of this species see André, 1906.

Remarks.—This species was rather incompletely described by André and has not been re-identified since. The species described by Dakin and Colefax (1936) as ? *Ct.*

picteti is nearly related but more probably belongs, as these authors consider, to *C. orientalis* Baba. *C. picteti* André must therefore be regarded as incompletely known.

Cephalopyge trematoides (Chun).

Phyllirhoë trematoides, Chun, 1889, p. 546.
Cephalopyge trematoides, Hanel, 1905, p. 451, pls. xxiii, xxiv.
Ctilopsis trematoides, Vessichelli, 1906, p. 131.
Boopsis trematoides, Pierantoni, 1923, p. 94.
Boopsis mediterranea, Pierantoni, 1923, p. 84, pls. iii, iv.
Boopsis mediterranea, Pruvot, 1929, p. 467, figs. 1–4.
Cephalopyge (*Cephalopyge*) *mediterranea*, Baba, 1933, p. 159.
Boopsis mediterranea, Bertolini, 1935, p. 67, fig. 3.

Recorded Distribution.—Canary Is. (Chun), Mediterranean (Pierantoni, Pruvot, Bertolini).

Description.—See Hanel (1905) and Pierantoni (1923).

Remarks.—Hanel (1905, p. 458) remarks that albumen, shell or other glands are absent. This is probably a mistake due to wrong interpretation of the very complicated genital mass, as other workers on this and other species describe these organs.

Dakin and Colefax (1937 p. 267) regard *C. mediterranea* and *C. trematoides* as separate species, but the differences, as already observed, are scarcely sufficient to warrant the retention of both species. Consequently *C. mediterranea* must be relegated to the position of a synonym of *C. trematoides*.

Cephalopyge orientalis Baba.

Cephalopyge (*Cephalopyge*) *orientalis*, Baba, 1933, p. 157, pl. vii.
? *Ctilopsis picteti*, Dakin and Colefax, 1936, p. 455, pls. iii, iv.

Recorded Distribution.—Shimizu Bay, Japan (Baba); South-east Australia (Dakin and Colefax).

Description.—See Baba, 1933.

Remarks.—Dakin and Colefax (1937), reviewing the position of their specimens, consider that they are nearer to this species than to *C. picteti* (André).

Cephalopyge arabica sp. nov.

Occurrence.—Central and Southern Arabian Sea.

Description.—See p. 1 *et seq.*

Geographical Distribution of the Genus *Cephalopyge*.

The distribution of the four species mentioned above is thus almost world-wide in tropical and subtropical waters. No records are known from the open waters of the Pacific Ocean, but this is doubtless due to our lack of knowledge of much of this region. The very small size of the Phyllirhoidæ is another factor tending to limit our knowledge of the family, as these animals may escape through the meshes of the net, and if caught are readily overlooked in sorting a large mass of zooplankton.

It is worthy of note that those records of *Cephalopyge* spp. for which the time of

year is known all lie within the period autumn to winter in both northern and southern hemispheres. These records are tabulated below:

Species.	Author.	Season.	Locality.
C. trematoides . . .	Chun, 1889	Winter	Canary Is.
,, . . .	Pierantoni, 1923	,,	Naples.
,, . . .	Bertolini, 1935	Nov.–Feb.	,,
? *C. picteti* (=*C. orientalis* Baba)	Dakin and Colefax, 1936	Aug.–Sept.	S.E. Australia.
C. orientalis	Baba, 1933	Nov	Japan.
C. arabica	sp. nov.	Dec., Feb.	Arabian Sea.

Thus it is probable that the species of this genus become adult, when they would be most likely to be captured owing to increased size, during the autumn, and live throughout the winter. The next generation would then be undergoing its larval development during the following summer when food conditions would be at their best. This is in accordance with Lo Bianco (1888, p. 420), who observed *Phyllirhoë bucephala* laying eggs in March and many with fertile eggs (" uova fecondate ") in March–April. This species also appears at Naples in the autumn and is caught throughout the winter. Schneider (1858, p. 35) also observed recently captured *Ph. bucephala* laying eggs somewhat later, namely in May.

The specimens of *C. arabica* are from localities near the equator where there is no winter as such. They were obtained, however, during the period of the N.E. monsoon, which is the coldest period of the year in the Arabian Sea. They thus agree with the other species in occurring as adults, as far as we know, during the colder part of the year. The specimen from Sta. 131D, taken in February, appears to contain well-developed eggs, so this species also probably breeds at the end of the cold season of the year.

A brief note is perhaps necessary concerning the recent paper by Dakin and Colefax (1936). These workers assert that " the group of the Phyllirhoids to which the genera *Ctilopsis* and *Boopsis* have both been relegated is thus known by *only four specimens* from the world's seas " (italics mine). As they rightly remark, André (1906) had three specimens and Pierantoni (1924) only one; but to these must be added five used by Hanel (1905) in describing *Cephalopyge trematoides*, one described by Pruvot (1929) and " several " known to Baba (1933) and Bertolini (1935). Thus more than a dozen specimens were known previous to the appearance of their paper. To this list must now be added the five specimens from S.E. Australia and the five collected by the " John Murray " Expedition, so that three of the four species recognized above are now each known from a number of specimens. *Cephalopyge trematoides* is particularly well known, having been recorded a number of times from the Gulf of Naples and neighbourhood as well as from the Canary Islands.

LIST OF REFERENCES.

André, E. 1906. Supplément aux Mollusques d'Amboine et description d'un nouveau genre de la famille des Phyllirhoïdes. Rev. suisse Zool. XIV, pp. 71–80, pl. i.

Baba, K. 1933. A pelagic Nudibranch *Cephalopyge orientalis* nov. sp. from Japan. Annot. zool. jap. XIV, pp. 157–160, pl. vii.

Bertolini, F. 1935. Note sulla sistematica dei Phylliroidæ. Pubbl. Staz. zool. Napoli, XV, pp. 60–70, text-figs. 1–4.

Chun, C. 1889. Berichte über eine nach den Canaren im Winter 1887/88 ausgeführte Reise. SB. preuss. Akad. Wiss. 1889, pp. 519–553, pl. iii.

Dakin, W. J., and Colefax, A. N. 1936. *Ctilopsis*, a rare Pelagic Nudibranch of the Family Phyllirhoidæ (Bergh). Proc. Zool. Soc. Lond. 1936 (2), pp. 455–460, pls. i–iv.

—— 1937. A Pelagic Nudibranch of the Family Phyllirhoidæ from the Waters of New South Wales : a Note on the Subgenera *Ctilopsis* and *Cephalopyge*. Ann. Mag. Nat. Hist. (10) XIX, pp. 266–271.

Hanel, E. 1905. *Cephalopyge trematoides* (Chun). Eine neue mollusken-Gattung. Zool. Jahrb. syst. XXI, pp. 451–466, pls. xxiii, xxiv.

Lo Bianco, S. 1888. Notizie biologiche riguardanti specialmente il periodo di maturità sessuale degli animali del golfo di Napoli. Mitt. zool. Sta. Neapel, VIII, pp. 385–440.

Pierantoni, U. 1923. Sopra un nuovo *Phyllirhoidæ* del golfo di Napoli (*Boopsis mediterranea* n.g., n.sp.). Pubbl. Staz. zool. Napoli, V, pp. 83–96, pls. iii, iv.

Pruvot, A. 1929. Note sur un rare mollusque pelagique de la Mediterranée, *Boopsis mediterranea* Pierantoni, 1924. Bull. Soc. zool. Fr. LIV, pp. 467–476, text-figs. 1–4.

—— 1929. Appendice à l'article de Mme. A. Pruvot-Fol sur *Boopsis mediterranea*. Bull. Soc. Zool. Fr. LV, pp. 570–571.

Schneider, A. 1858. Über die Entwicklung der *Phyllirhoë bucephalum* Arch. Anat. Physiol. Lpz. Jhg. 1858, pp. 35–37, pl. iii.

Thiele, J. 1931. Handbuch der systematischen Weichtierkunde. Bd. I, t. 2, pp. 377–778, figs. 471–783. Jena.

Vessichelli, N. 1906. Contribuzioni allo studio della *Phyllirhoë bucephala* Péron & Lesueur. Mitt. zool. Sta. Neapel, XVIII, pp. 105–135, pls. v, vi.

—— 1910. Contribuzioni allo studio della *Phyllirhoë bucephala* Mitt. zool. Sta. Neapel, XX, pp. 108–128, pl. v.